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A BOTANICAL STUDY OF SKUNK CABBAGE, SYMPLOCARPUS FOETIDUS

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The skunk cabbage is a plant of unusual interest and wide distribution, and although its general growth and morphology are pretty well understood, little has been done in an exact study of the plant. A recent study of its western congener, *Lysichiton Kamtschaticensis*, has emphasized the importance of a detailed investigation of the eastern swamp plant. This study was begun early in the spring of the present year (1918) with a view to making known some of the features of the plant which have not been emphasized in previous descriptions of it. In the prosecution of this research, I have been assisted by the helpful suggestions of Prof. John W. Harshberger, under whose direction the work has been prosecuted throughout.

PHYTOPHENOLOGY AND DISTRIBUTION

Phytophenology.—The skunk cabbage is one of our earliest forest plants, for records show it blooming even in the late fall, or early winter. According to the records made by Dr. Marion Mackenzie and presented before the Botanical Society of Pennsylvania, flowering specimens have been found as early as November twenty-first. Also when the year is backward for any reason, the flowers have been even as late as March before opening. The average date of first blooming seems to be about the middle of January, as seen from the following table. This year the flowering was somewhat later than usual.

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LIBR
NEW Y
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MAR 24 1919

Year	Date of Opening of First Flower
1899.....	March 8
1900.....	February 22
1901.....	February 18
1902.....	January 27
1903.....	January 15
1904.....	January 23
1905.....	January 18
1906.....	January 5
1907.....	January 10
1908.....	January 1
1909.....	November 21 (1908)
1918.....	March 9

Daily more and more flowers open until about the latter part of February and early March when they are at their height. Then the greatest numbers may be found open. Of course the date varies slightly owing to the general weather conditions.

Distribution.—In general the plants are found in the eastern coastal states, although a closely allied species is found throughout the west and is there spoken of as the western skunk cabbage, or *Lysichiton Kamtschatcensis*. It is common around Vancouver. In general, though, *Symplocarpus* is distributed along our eastern states, ranging from Nova Scotia down to Virginia and is also reported by the Gray Herbarium of Harvard University, as having been found in Amur and Japan.

The following table gives in general its distribution.

States	Number of Herbariums Reporting
Canada.....	2
Maine.....	3
New Hampshire.....	2
Vermont.....	1
Massachusetts.....	4
Rhode Island.....	2
Connecticut.....	4
Long Island.....	2
New York.....	3
New Jersey.....	3
Pennsylvania.....	2
District of Columbia.....	1
Maryland.....	1
Virginia.....	1

States	Number of Herbariums Reporting
Tennessee.....	1
Iowa.....	1
Indiana.....	1
Ohio.....	2
Michigan.....	2
Wisconsin.....	3
Minnesota.....	1
Nova Scotia.....	2
Quebec.....	1
Amur.....	1
Japan.....	1

Symplocarpus, like some other members of the Arum family, grows best with a great deal of moisture. And it is in the swamps, marshes and bogs or stream beds, that these sturdy plants are usually found.

GENERAL STUDY

The skunk cabbage, or *Symplocarpus foetidus*, is really our earliest spring flower.

Odor of Plant.—Knuth in his classification of flower odors describes it as nauseous and of mephitic, or viverrine, type. In another case, I found it described as an odor that combines the skunk, putrid meat and garlic. Still another writer describes it as being a combination of a mustard plaster and raw onions. To me the odor is not especially repulsive. It suggests that of fresh cabbage with a slight suggestion of mustard. To some, however, the smell is quite repulsive.

The odor varies in intensity and quality quite widely. Those plants in which the stamens are ripe seem to have the stronger odor. This is probably due to the greater maturity of the plant at this stage of flowering and it has the added significance of attracting a greater number of insect visitors.

Origin of name.—The origin of its common name is not difficult to ascertain, for on crushing the plant immediately an odor arises something like that of the cabbage with yet a suggestion of the mephitic skunk.

The generic name of the plant, *Symplocarpus* was given to it by Richard Anthony Salisbury, and is derived from two Greek

words *συμπλοκή*, meaning connection and *καρπός*, fruit. This is quite appropriate, since the ovaries unite to form a compound fruit. Linnaeus gave us its specific name of *foetidus*. Many scientists use the term *Spathyema*, as given by Rafinesque. A point interesting in regard to its name is that the early Swedish settlers around Philadelphia called it bear-weed, because the bears relished the early green food and feasted on its leaves, which are quite large and conspicuous, like coarse cabbage leaves.

Order and family.—We have heard so much about its disagreeable odor that we hardly realize that it belongs to the same family as our Calla lily, for it is a member of the family Araceae. According to Gray, "they are plants with acrid or pungent juices, simple or compound often veiny leaves and flowers crowded on a spadix which is normally surrounded with a spathe." Other closely allied plants, which we find around here, are the golden club, so common in Jersey ponds and the familiar jack-in-the-pulpit. Neither of these, however, possesses the pungent odor, but the Jack, or Indian turnip, is like *Symplocarpus* in that it has many crystals found in the root, which give it a biting clawing taste.

EARLY GROWTH

Flower, spathe.—The first signs of the plant are the sessile hood-shaped spathes which come up though the ground early or late in the winter, even when the ground is hard with ice at a foot's depth. The flowers are included in a thick leathery spathe. This in general is like a hood, or even shell-shaped. It is sessile and grows close to the ground. In most instances, it has the same general form, although there is a wide variation in contour, size and coloring. Some of these leaf-like spathes are deeply curved, others stand more erect. Some are found which are double. In this case there seems to be a spathe inside a spathe, the open part of the outer spathe coming against the rounded back of the inner spathe. Also in such cases the innermost spathe seems to have a longer, more leaf-like tip which projects backward and out beyond the outer spathe tip. One plant was found this spring (1918) at South Springfield, Pa., with four double spathes.

The greatest variation is seen in the coloring. Usually this ranges from a deep purplish-red, almost black, to a pale yellowish green. Spathes may be found showing the different colors and a complete gradation shown from the light to the dark. The lighter spathes are rarely ever pure pale green, but more frequently are mottled with the deeper purple. In some instances the inner side of the spathe is deeper colored than the outer. The mottling is such that it closely resembles the flickering lights and shades often seen on the undergrowth, as the sun filters through the leaves of the trees overhead. This frequently makes it hard to find them on the forest floor. Reed suggests that this variation is due to age, the younger blooms being those lighter in color, while those which are darker are the older ones. This did not seem to hold true as regards the plants observed by me. Out of about fifty examined for this peculiarity, withering and decay was not limited to the dark ones alone, but was seen in spathes of all intermediate shades of coloring. Again it was suggested that the water content of the soil might lead to this variation. Some time spent on this study did not seem to prove this to hold true, as two spathes from the same plant, side by side, showed one a deep reddish purple and the other quite pale.

The flowers themselves are crowded together on a short stalk or spadix. They are really quite inconspicuous. It is the spathe that is the attractive portion, as far as coloring and conspicuousness are concerned. The flowers themselves are closely crowded on the spadix, so closely crowded that they hardly appear as individual flowers. The stamens and pistil only are conspicuous. The flower cluster varies in size and in the number of flowers produced. Showing this variation we have the following table.

Size relatively	Size in inches	No. of flowers
Small	5/8''	38
Medium	7/8''	73
Large	7/8''	69
Very large	13/16''	61

The flowers as shown by the figures are closely crowded together. In this case, the spadix of medium size had the greatest number of flowers. And the largest spadix had only 61 flowers.

It is due mostly to this crowding that the flowers have departed somewhat from the usual monocotyledonous habit of having three, or its multiple, in their floral parts. In general the flowers showed four perianth parts. These were almost cuboidal in shape, when pressed close together, and they overlapped each other, making a box-like arrangement. The four stamens have long flat, broad filaments and straw-colored anthers, which protrude beyond the perianth segments. The stamens are arranged opposite the perianth parts. The anthers are two-celled, opening lengthwise and are extrorse and rather free in their movement. The flowers are protandrous, the anthers developing earlier than the pistil. The pistil is unusual in its general structural form. The stigma is three-lobed, the style is cuboidal and the ovary is one-celled.

In a cluster of about 73, some flowers showed a few variations. These were either near the lip or the base where less crowded. It seemed an attempt to revert to the usual number of parts in the lilaceous monocotyledones. Four specimens were found having six stamens and six perianth parts. Another flower showed five stamens and five perianth parts. And still another specimen was found having four stamens, but with six perianth segments.

The color of the flowers, according to one author, resembling decayed flesh, combined with the odor which is doubly suggestive, attract carrion-loving flies of the family Diptera, which are useful in the pollination of the closely crowded, otherwise inconspicuous blossoms.

Insect visitors.—From a recent article in *American Forestry* by R. W. Shufeldt, I find that a variety of bee introduced into this country from Europe is one of the earliest visitors, since they must have food early in the spring. The article further states that the honey bee, if able at all to enter, finds the exit too narrow and slippery and the bee perishes miserably. Another curious fact he has noted also is the frequent presence of spiders' webs at the entrance to the spathes. This fact was also noted by me. It is a case where the flower odor attracts the flies, and they in turn are entangled in the spider's web and so furnish food for the spider.

Shortly after pollination the spathe begins to decay and wither and the spadix to swell. It becomes soft and spongy and the individual fruits are covered with a papery skin-like sheath under which the seeds develop. These when mature are hard, round, dark brown and somewhat irregular in shape. In fact, they look a little like pebbles or stones. When fully ripe they break the sheath, fall to the ground and germinate the following spring, giving rise to new plants. A parent plant may be found having many seedlings coming up close around it.

In germination a small pointed, closely coiled shoot first appears above the ground. This is carefully wrapped in the thin papery sheathing leaves. When about a week old this shoot is about an inch in length. A few slender fibrous roots, rather long and thin grow downward into the ground. As yet there are not many roots to nourish the plant; these few primary roots have thread-like secondary roots.

By the second week, the seedling has grown much larger and the tip of the shoot has become freed from its papery sheath. This however grows along with the young plant. Also by this time a rootstock begins to develop. There are also many more roots, long, thin and tapering.

At the third week, the shoot has broken through both sheathing leaves and is quite large. At this time the seedling is about four inches tall. It has severed its connection with the remains of the seed by this time. From now on development consists of growing larger and larger rapidly. This plant however does not bloom the first year. Nor am I able to tell by actual observation, since my study has covered only a period of five months, how many years elapse before the plant has grown old enough to produce its first inflorescence. Probably the flowers are produced the fourth year.

That the plants develop more rapidly and better in warm, light places is seen by the table given by Dr. Mackenzie in her report before the Botanical Society in 1911. Also in some specimens which I brought in from the wood, the uncurled spire of leaves, just barely sticking above the soil, soon came into full leafage, in the warmth of the greenhouse. The plants had been

set aside in a bucket of water, as of little further use. In less than a week after bringing them in about six leaves were fully uncurled and widely spread.

The leafage of the plant is quite interesting. Soon after the blossoms appear, a small whitish shoot is seen forcing its way above ground. On going one can see that it consists of two almost whitish sheathing leaves. These show the monocotyledonous character in having parallel veining. Closely rolled inside of these are the true leaves. They form a light hard-coiled center. The tips, when they have broken through the enveloping sheath-like leaves, are frequently colored purplish like the spathe of the plant. Such coloring may show on the outside of the tip of the first and even the second leaves. These inner, or true, leaves seem to break away from the monocotyledonous and tend toward the netted veining of dicotyledonous plants. The first three leaves unfolding show a gradual transition toward the netted veining of the later leaves. In all the cases the veining is palmately netted. Also in specimens planted under dry conditions, in a pot in a frame, and those under moist conditions, the plants grown under dry conditions tended to show the netted veining earlier than those of the moist environment.

The leaves when fully developed are quite large, being sometimes over a foot in length and at least eight or nine inches broad. They have an entire margin and are of a bright green color, rather shiny in appearance. They grow rankly in a rosette form, in the damp stream beds. Their great size makes them very conspicuous.

In a microscopical study the leaves show rather large air chambers and loosely packed cellular structures. Throughout the leaf are various raphides occurring in the large bundle masses. There are also several other types of crystals, a few cuboidal in shape, and even some spherical in shape may be found scattered loosely here and there—sphaerocrystals.

Juice.—The juice of the skunk cabbage is very bitter and acrid. This when tasted in the fresh plant had a peculiar garlic-like taste and seemed biting. By biting I mean the prickly sensation very much like that experienced on eating the root of

